Chemistry 395 (445) — Spring 2014

Course: Chemistry 395	Instructor: Prof. Jacob Ciszek
Date: Tuesday, Thursday	Flanner Hall 122
Time: 5:45-7:00 p	Phone: (773) 508-3107
Location: Flanner Hall 105	E-mail: jciszek@luc.edu
Textbook: Cao & Wang <u>Nanostructures and Nanomaterials</u>	Website: Sakai

<u>Course Title:</u> Introduction to Nanoscience
<u>Course Number:</u> There are various course numbers for the class. For simplicity everything will be listed under Chemistry 395 from here on out (for example course reserves).

<u>Course Philosophy:</u> Chemistry 395 is designed to be an introductory overview of all of nanoscience. As such it is interdisciplinary and *very* broad. You will learn about the various tools and techniques by which nanoscale materials are generated and analyzed as well as the many applications of these materials. I will also emphasize creative thinking in this course. By the end of the course, the goal is for you to be confronted with a very real nanotechnology problem (for example generating and characterizing a phospholipid bilayer pattern with 100 nm resolution) and for you to suggest one of many ways to solve this problem. In addition, as an overview course we will highlight other important aspects of nanoscience such as health, ethics, policy/outreach, literature, and scientific misconduct.

<u>Before you enter class on January 14th:</u> It is expected that everyone in the class will have a good (B or better) understanding of general chemistry. If you struggled or have forgotten material from the class I suggest you review it. Nearly all topics should be second nature to you. The only material that will not be used regularly will be nuclear chemistry, and aqueous chemistry will only be used periodically. Other advanced chemistry and biology classes will obviously simplify the learning curve, but are not required. Advanced topics (for example Miller indices) will be explained in the context of the course, but will be left to you to cover in depth.

<u>Office Hours:</u> Office hours consist of the following time slots (2.5h total):
Wednesdays 1:00 to 2:15 PM (except 1/29)
Fridays 1:00 to 2:15 PM (except 1/17, 1/31)

<u>Academic Honesty & Discipline:</u> Honesty is the foundation of the academic system and hence is of the utmost importance. All exam answers should be exclusively your own work and no outside materials are allowed. In the unfortunate event that a student is caught cheating, 100 points will be deducted from your total grade and you will be brought to the attention of the Department Chair and Dean of the College who will determine if further action should be taken.

<u>Grading:</u> The majority of the grade in this course comes from examinations. The two in-class exams are "cumulative" to the extent that the latter half of the class builds heavily off of the former. Specifics (such as "draw a schematic of a TEM") will not carry from one in-class exam to the next. The final <u>is</u> comprehensive covering all material, though focusing more on the second half of the class. Problem sets are assigned at regular intervals and are due at the start of the listed class period. Teamwork is allowed on the problem sets so long as team members are clearly identified.

Grading Scale:

Problem Sets:	6 × 25 pts	150	A> 80%
Exams	2 × 120 pts	240	B> 65%
Final	210 pts	210	C> 50%
Total		600	D> 35%

Pluses and minuses are not indicated in the grading scale but will be given. This will be done according to the natural breakdown of the grade distributions. Expect this to be the closest 1-2% to the final A-B, B-C, and C-D divisions.

Supplementary Texts: These contain additional information about different aspects of the class.
Characterization tools – see Brandon & Kaplan's Microstructural Characterization of Materials
Characterization tools – see Magonov & Whangbo's Surface Analysis with STM and AFM
Characterization tools – see Skoog, Holler, & Nieman's Principles of Instrumental Analysis
Scientific misconduct – see Reich's Plastic Fantastic
Forces – see Israelachvili's Intermolecular & Surface Forces
All are on reserve at Cudahy.

Approximate schedule (including assigned reading):

1/14	Nano: the size regime. Syllabus	1	1.0-1.5	
1/16	Importance of surfaces and size	2	2.1-2.3	
1/21	Importance of energy, kinetics, thermodynamics	3	2.3	
1/23	The forces of nano; monolayers	4	Israelachvili, 2.4-2.6, 5.8, 5.9	
1/28	Characterization tools: electron microscopy	5	B&K, 8.2.3, 8.2.4	PS 1 due
1/30	Characterization tools: SPM	6	M&W, 8.2.5	
2/4	Characterization tools: chemistry, mat. sci. tools	7	Skoog, 8.2.1, 8.2.2, 8.3	
2/6	Synthesis tools: materials science	8	7, 5.1-5.6	PS 2 due
2/11	Synthesis tools: chemistry	9	3, 4.2.2,4.3	
2/13	Synthesis tools: biology	10		
2/18	Scientific misconduct: Schon and Snuppy	11	Plastic Fant. (optional)	PS 3 due
2/20	Exam 1			Exam 1
2/25	Literature, science, and academics	12		
2/27	The need for nano: an intro to particle properties	13	9.1-9.7	
3/11	Nanoparticles: an overview	14	6.1-6.3	
3/13	Nanoelectronics. Nanospectroscopy	15	8.4.4	PS 4 due
3/18	Materials properties	16	8.4.1,8.4.2	
3/20	Electric fields, plasmons, photonic crystals, light	17	8.4.3, 9.11	
3/25	Superstructures. Collective effects. Patterning	18		PS 5 due
3/27	Detection: biological, chemical	19		
4/1	Imaging. Contrast. Targeting	20		
4/3	Exam 2			Exam 2
4/8	Integrative approach – Nano-solutions 1	21		
4/10	Integrative approach – Nano-solutions 2	22		
4/15	Integrative approach – Nano-solutions 3	23		PS 6 due
4/17	Easter			
4/22	History & industrial application	24		
4/24	Nano as art. Environmental/safety implications	25		
4/29	Final 5:45p			Final

Problem sets are due at the start of the class period on the indicated days